Abstract

A vertical shaft melting furnace is operated in a method that includes firing a plurality of burners to generate combustion products, and directing jets of the combustion products into the shaft in a bottom region of the shaft. The method further includes directing a jet of hot gas into the shaft in an upper region of the shaft in a non-radial direction, whereby the jet of hot gas can induce a swirl to disperse a concentrated channel of combustion products rising from the bottom region to the upper region through a void in unmelted portions of a load of metal pieces in the shaft. The jet of hot gas directed into the upper region of the shaft can include recirculated flue gas, a mixture of air and recirculated flue gas, or combustion products that are generated by a burner. If the jet of hot gas includes combustion products that are generated by a burner, the burner is a secondary burner that preferably is fired into the shaft with a relatively low heat input. In each case, the jet of hot gas preferably is one of a plurality of jets of hot gas that are directed into the shaft in the upper region of the shaft, and preferably at an uppermost level, in non-radial directions that together extend in a common direction circumferentially around the inside of the shaft.